$$\dot{n}_{exh} = \frac{3.780}{\left(1 + \frac{(0.69021 - 1.10764)}{(1 + 0.10764)}\right)}$$

$\dot{n}_{exh}$ = 6.066 mol/s

(3) *Fuel mass flow rate calculation.* Based on m_{fuel}, calculate $\dot{n}_{exh}$ as follows:

$$\dot{n}_{exh} = \frac{\dot{m}_{fuel} \cdot w_c \cdot \left(1 + x_{H2Oexhdry}\right)}{M_c \cdot x_{Ccombdry}} \qquad \text{Eq. 1065.655-19}$$

Where:

$\dot{n}_{exh}$ = raw exhaust molar flow rate from which you measured emissions.

$\dot{m}_{fuel}$ = fuel flow rate including humidity in intake air.

Example:

$\dot{m}_{fuel}$ = 7.559 g/s

w_C = 0.869 g/g

M_C = 12.0107 g/mol

$x_{Ccombdry}$ = 99.87 mmol/mol = 0.09987 mol/mol

$x_{H20exhdry}$ = 107.64 mmol/mol = 0.10764 mol/mol

$$\dot{n}_{exh} = \frac{7.559 \cdot 0.869 \cdot (1 + 0.10764)}{12.0107 \cdot 0.09987}$$

$\dot{n}_{exh}$ = 6.066 mol/s

§ 1065.659 Removed water correction.

(a) If you remove water upstream of a concentration measurement, *x*, or upstream of a flow measurement, *n*, correct for the removed water. Perform this correction based on the amount of water at the concentration measurement, $x_{H2O[emission]meas}$, and at the flow meter, x_{H2O}, whose flow is used to determine the concentration's total mass over a test interval.

(b) Downstream of where you removed water, you may determine the amount of water remaining by any of the following:

(1) Measure the dewpoint and absolute pressure downstream of the water removal location and calculate the amount of water remaining as described in § 1065.645.

(2) When saturated water vapor conditions exist at a given location, you may use the measured temperature at that location as the dewpoint for the downstream flow. If we ask, you must demonstrate how you know that saturated water vapor conditions exist. Use good engineering judgment to measure the temperature at the appropriate location to accurately reflect the dewpoint of the flow.

(3) You may also use a nominal value of absolute pressure based on an alarm setpoint, a pressure regulator setpoint, or good engineering judgment.

(c) For a corresponding concentration or flow measurement where you did not remove water, you may determine the amount of initial water by any of the following:

(1) Use any of the techniques described in paragraph (b) of this section.

(2) If the measurement comes from raw exhaust, you may determine the amount of water based on intake-air humidity, plus a chemical balance of fuel, intake air and exhaust as described in § 1065.655.

(3) If the measurement comes from diluted exhaust, you may determine the amount of water based on intake-air humidity, dilution air humidity, and a chemical balance of fuel, intake air, and exhaust as described in § 1065.655.

(d) Perform a removed water correction to the concentration measurement using the following equation:

$$x = x_{[emission]meas} \cdot \left[\frac{1 - x_{H2O}}{1 - x_{H2O[emission]meas}} \right] \quad \text{Eq. 1065.659-1}$$

Example:

x_{COmeas} = 29.0 μmol/mol

$x_{H2OxCOmeas}$ = 8.601 mmol/mol = 0.008601 mol/mol

x_{H2O} = 34.04 mmol/mol = 0.03404 mol/mol

$$x_{CO} = 29.0 \cdot \left[\frac{1 - 0.03404}{1 - 0.008601} \right]$$

x_{CO} = 28.3 μmol/mol

EFFECTIVE DATE NOTE: At 73 FR 37335, June 30, 2008, §1065.659 was revised, effective July 7, 2008. For the convenience of the user, the revised text is set forth as follows:

§1065.659 Removed water correction.

(a) If you remove water upstream of a concentration measurement, *x*, or upstream of a flow measurement, *n*, correct for the removed water. Perform this correction based on the amount of water at the concentration measurement, $x_{H2O[emission]meas}$, and at the flow meter, x_{H2Oexh}, whose flow is used to determine the concentration's total mass over a test interval.

(b) When using continuous analyzers downstream of a sample dryer for transient and ramped-modal testing, you must correct for removed water using signals from other continuous analyzers. When using batch analyzers downstream of a sample dryer, you must correct for removed water by using signals either from other batch analyzers or from the flow-weighted average concentrations from continuous analyzers. Downstream of where you removed water, you may determine the amount of water remaining by any of the following:

(1) Measure the dewpoint and absolute pressure downstream of the water removal location and calculate the amount of water remaining as described in §1065.645.

(2) When saturated water vapor conditions exist at a given location, you may use the measured temperature at that location as the dewpoint for the downstream flow. If we ask, you must demonstrate how you know that saturated water vapor conditions exist. Use good engineering judgment to measure the temperature at the appropriate location to accurately reflect the dewpoint of the flow. Note that if you use this option and the water correction in paragraph (d) of this section results in a corrected value that is greater than the measured value, your saturation assumption is invalid and you must determine the water content according to paragraph (b)(1) of this section.

(3) You may also use a nominal value of absolute pressure based on an alarm set point, a pressure regulator set point, or good engineering judgment.

(4) Set $x_{H2O[emission]meas}$ equal to that of the measured upstream humidity condition if it is lower than the dryer saturation conditions.

(c) For a corresponding concentration or flow measurement where you did not remove water, you may determine the amount of initial water by any of the following:

(1) Use any of the techniques described in paragraph (b) of this section.

(2) If the measurement comes from raw exhaust, you may determine the amount of water based on intake-air humidity, plus a chemical balance of fuel, intake air and exhaust as described in §1065.655.

(3) If the measurement comes from diluted exhaust, you may determine the amount of water based on intake-air humidity, dilution air humidity, and a chemical balance of fuel, intake air, and exhaust as described in §1065.655.

(d) Perform a removed water correction to the concentration measurement using the following equation:

$$x = x_{[emission]meas} \cdot \left[\frac{1 - x_{H2Oexh}}{1 - x_{H2O[emission]meas}} \right] \quad \text{Eq. 1065.659-1}$$